جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Modelling Naturally Fractured Reservoirs - ErSE 390G

Division	Physical Science and Engineering Division
Course Number	ErSE 390G
Course Title	Modelling Naturally Fractured Reservoirs
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	09:00 AM - 10:30 AM | Thu , 10:30 AM - 12:00 PM | Sun

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Hussein Ali Hoteit	HUSSEIN.HOTEIT@KAUST.EDU.SA	+966128084897	3221, 5, Al-Kindi (bldg. 5)	Sun & Thu: 03:00 PM- 05:30 PM , office 5/3221

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	Modeling naturally fractured reservoirs (NFR) is regaining interest in the industry and academia thanks to the revolution in unconventional hydrocarbon and EOR in carbonate fractured reservoirs. This course provides an overview of naturally fractured reservoirs (NFR) and focuses on traditional methods in commercial reservoir simultors and advanced methods to model NFR. The course includes: 1) Introduction on NFR: definitions, importance, detection methods, characterization; 2) Single porosity model: multiphase flow, matrix-fracture interaction (diffusion, imbibition, infiltration), gridding, limitations; 3) dual porosity/dual-permeability models: derivations, shape factor, transfer functions, limitations; 4) Discrete fractured models; 2D/3D gridding simplifications; 5)Advanced methods; Finite Element (FE), Control-Volume FE, Mixed FE; 6) DFN upscaling: static/dynamic upscaling, single-phase/multi-phase upscaling. Note: students are expected to have at least basic familiarity with: Multi-phase flow in porous media, and programming in Matlab or Python
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Goals and Objectives	After completing this course, students will be able to : -understand the significance of NFR and the modeling complexity -know about different secondary and tertiary recovery schemes in conventional and unconventional NFR -know about key multiphase flow mechanisms in NFR such as capillarity, gravity, wettability and diffusion -know about the traditional single-porosity and dual-porosity/dual-permeability methods in modeling NFR, their strength and limitations -know how to use a commercial reservoir simulator (CMG or Eclipse) to model fractured reservoirs -get familiarized with the state-of-the-art in discrete fractured reservoir modeling using finite-element based methods
Required Knowledge	Students are expected to have at least a basic familiarity with Multi-phase flow in porous media, and programming in Matlab or Python
Reference Texts	-Course material -Dietrich et al., Flow and Transport in Fractured Porous Media, Springer, 2005 -Wu, Multiphase Fluid Flow in Porous and Fractured Reservoirs, Elsevier 2016 -Ertekin, J. Abou-Kassem and G. King; Basic Applied Reservoir Simulation, SPE 2001
Method of evaluation	**10.00**% - Attendance and Participation **30.00**% - Tests **40.00**% - Research Project **20.00**% - Homework /Assignments
Nature of the assignments	Model coding in Excel , Matab, Python or others Written assignments Paper presentation Research project with a presentation
Course Policies	For absense and late assignements, discusss with instructor beforehand
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/28/2018 Thu 02/01/2018	[{"DayId":2012018,"Details":" Introduction: importance of NFR, fracture types, NFR classification, fracture detection methods ","Id":1}]
2	Sun 02/04/2018 Thu 02/08/2018	[{"DayId":2082018,"Details":" Characterization workflow: data acquisition, analysis, stochastic,upscaling ","Id":2}]
3	Sun 02/11/2018 Thu 02/15/2018	[{"DayId":2152018,"Details":" Flow mechanisms in NFR(wettability, capillarity, gravity, diffusion, viscous forces) ; homework ","Id":3}]
4	Sun 02/18/2018 Thu 02/22/2018	[{"DayId":2222018,"Details":" Modeling methods: single porosity model; homework ","Id":4}]
5	Sun 02/25/2018 Thu 03/01/2018	[{"DayId":3012018,"Details":" Dual porosity/dual permeability models; homework ","Id":5}]
6	Sun 03/04/2018 Thu 03/08/2018	[{"DayId":3082018,"Details":" Reservoir Simulator training (computer lab.) ","Id":6}]
7	Sun 03/11/2018 Thu 03/15/2018	[{"DayId":3152018,"Details":" Reservoir Simulator training (computer lab.) ","Id":7}]
8	Sun 03/18/2018 Thu 03/22/2018	[{"DayId":3222018,"Details":" Review / Midterm Exam; ","Id":8}]
9	Sun 03/25/2018 Thu 03/29/2018	[{"DayId":3292018,"Details":" Discrete fractured network (DFN) modeling : finite element based methods, 2D gridding; homework ","Id":9}]
10	Sun 04/01/2018 Thu 04/05/2018	[{"DayId":4052018,"Details":" DFN modeling: FE based methods ","Id":10}]
11	Sun 04/08/2018 Thu 04/12/2018	[{"DayId":4122018,"Details":" DFN modeling : finite-volume based methods; homework ","Id":11}]
12	Sun 04/15/2018 Thu 04/19/2018	[{"DayId":4192018,"Details":" DFN modeling: mixed FE based methods; homework ","Id":12}]
13	Sun 04/22/2018 Thu 04/26/2018	[{"DayId":4262018,"Details":" Final project assignment description; previous homework will feed into the final project ","Id":13}]
14	Sun 04/29/2018 Thu 05/03/2018	[{"DayId":5032018,"Details":" 3D DFN gridding for different FE methods ","Id":14}]
15	Sun 05/06/2018 Thu 05/10/2018	[{"DayId":5102018,"Details":" Upscaling (single phase) ","Id":15}]
16	Sun 05/13/2018 Thu 05/17/2018	[{"DayId":5172018,"Details":" Upscaling (multi phase) ","Id":16}]
17	Sun 05/20/2018 Thu 05/24/2018	[{"DayId":5242018,"Details":" Project progress and update / Final Exam ","Id":17}]
18		[]

Note

The instructor reserves the right to make changes to this syllabus as necessary.